

CLAIMS

1. A biochip characterized by comprising a well(s) having, at its bottom, a filter comprising straight pores
5 with a uniform diameter arranged at uniform pore spacings.

2. The biochip according to claim 1, characterized in that said filter has a thickness of 1 to 10 μm .

3. The biochip according to claim 1 or 2, characterized in that the open area ratio of the filter is
10 15 to 60%.

4. The biochip according to any one of claims 1 to 3, characterized in that the surface of the filter is formed of silica, titania, or alumina.

5. The biochip according to any one of claims 1 to 4,
15 characterized by comprising a plurality of said wells provided integrally with each other.

6. The biochip according to any one of claims 1 to 4, characterized in that said well is singularly provided.

7. The biochip according to any one of claims 1 to 6,
20 characterized in that a reinforcing rib part is provided on the upper side or lower side of said filter in said well.

8. The biochip according to claim 7, characterized in that said reinforcing rib part is of an integral type provided with a plurality of through-holes.

9. The biochip according to claim 7 or 8, characterized in that said reinforcing rib part is joined directly to said filter.

10. The biochip according to claim 7 or 8,
5 characterized in that said reinforcing rib part is formed so as to continuously extend from said filter, said reinforcing rib part and said filter being formed of an identical material.

11. The biochip according to any one of claims 1 to
10 10, characterized in that a nonporous part free from pores of said filter is provided on the bottom of said well in a predetermined width from the periphery of said well.

12. The biochip according to any one of claims 1 to
11, characterized in that a first filter is provided at the
15 bottom of the well(s) and a second filter is provided on the side opposite to the first filter so that the well(s) is sandwiched between said first and second filters.

13. The biochip according to any one of claims 1 to
12, characterized in that a dispersion with probe-supported
20 particles dispersed therein is placed in said well(s).

14. The biochip according to claim 13, characterized in that the ratio between the diameter of said particles and the pore diameter of said filter is particle diameter/pore diameter = 1.1 to 2.5, and said particle

diameter and said pore spacing satisfy a relationship represented by formula: particle diameter < pore spacing < particle diameter x 10.

15 15. The biochip according to claim 13, characterized in that the diameter of said particle and the pore diameter and pore spacing of said filter satisfy a relationship represented by formula: particle diameter > pore diameter + pore spacing/2.

10 16. The biochip according to claim 13, characterized in that said well contains a dispersion in which probe-supported particles having at least one identification means for providing probe identification information has been dispersed.

15 17. The biochip according to claim 16, characterized in that said identification means is at least one means selected from color, shape, diameter and gene sequence in said probe-supported particle.

20 18. The biochip according to claim 16 or 17, characterized in that a plurality of probe-supported particles which are identical to each other in probe identification information in all of said identification means are contained in an identical well and said wells are identical to each other in said probe identification information for a plurality of probe-supported particles

contained therein.

19. The biochip according to claim 16 or 17, characterized in that a plurality of probe-supported particles which are identical to each other in probe
5 identification information in all of said identification means are contained in an identical well and said wells are different from each other in said probe identification information for a plurality of probe-supported particles contained therein.

10 20. The biochip according to claim 16 or 17, characterized in that a plurality of probe-supported particles which are different from each other in probe identification information in said at least one
15 identification means are contained in an identical well and said wells are identical to each other in construction of said probe identification information in all the identification means for a plurality of probe-supported particles contained therein.

21. The biochip according to claim 16 or 17,
20 characterized in that a plurality of probe-supported particles which are different from each other in probe identification information in said at least one identification means are contained in an identical well and said wells are different from each other in construction of

said probe identification information in at least one of said identification means for a plurality of probe-supported particles contained therein.

22. A biochip kit characterized by comprising: a
5 vessel; and a plurality of wells formed integrally with each other or a single well in the biochip according to any of claims 1 to 21 housed in or connected to said vessel.

23. The biochip kit according to claim 22,
characterized in that said vessel is formed integrally with
10 said well(s).

24. The biochip kit according to claim 22,
characterized in that said vessel is formed independently of said well(s).

25. The biochip kit according to any of claims 22 to
15 24, characterized in that said vessel is provided with well(s) corresponding to said well(s) in said biochip.

26. The biochip kit according to claim 25,
characterized in that a through-hole is provided at the bottom of said well(s) in said vessel.

20 27. The biochip kit according to claim 25 or 26, characterized in that said biochip and said vessel are connected to each other so that the corresponding wells are connected to each other.

28. The biochip kit according to any of claims 22 to

27, characterized in that said vessel comprises a plurality of plates stacked on top of each other, said plurality of plates being each selected from plates with a through-hole and plates free from a through-hole.

5 29. A biochip kit characterized by comprising a plurality of biochips according to any of claims 1 to 21 which are connected to each other so that the corresponding wells are connected to each other.

 30. The biochip kit according to any of claims 22 to
10 29, characterized in that the flat part provided on the lower end of the well side part in said biochip is connected directly to the flat part provided on the upper end of the well side part in said separate vessel or said separate biochip so that the wells are connected to each
15 other.

 31. The biochip kit according to any of claims 22 to
20 29, characterized in that either a positioning concave part into which a convex part provided on the upper end of the well side part in said separate vessel or said separate biochip is to be fitted, or a positioning convex part into which a concave part provided on the upper end of the well side part in said separate vessel or said separate biochip is to be fitted is provided on the lower end of the well side part in said biochip.

32. A process for producing a biochip according to any of claims 1 to 21, characterized by comprising: providing a plate having a structure of at least two layers different from each other in composition of a material
5 constituting the layer; subjecting said plate to pattern etching from its one side to the boundary between the two layers to form a well hole(s); and subjecting said plate to pattern etching from its other side to the boundary between the two layers to form filter pores, thereby preparing a
10 biochip comprising a well(s) and a filter connected to each other.

33. A process for producing a biochip according to any of claims 1 to 21, characterized in that silicon wafers are etched to prepare a filter, a rib, and a well which are
15 then stacked on top of each other.

34. A method for operating a biochip kit, characterized in that, in a biochip kit according to any of claims 22 to 31 comprising said vessel and said biochip, said vessel being provided independently of said well(s) in
20 said biochip, a solution is placed in said vessel and said well(s) in said biochip is vertically moved in said solution to bring said solution in said vessel into contact with said probe-supported particles and/or solution within said well(s).

35. A method for operating a biochip kit, characterized in that the interface of a solution contained in said vessel in a biochip kit according to any of claims 22 to 31 is vertically moved to bring said solution in said
5 vessel into contact with said probe-supported particles and/or solution within said well(s).

36. A method for operating a biochip kit, characterized in that, in a biochip kit according to any of claims 22 to 31 comprising said vessel for housing said
10 biochip therein, a pressure differential is created between said vessel and said chip or between mutual wells in said chip to cause contact of a liquid with said probe-supported particle within said well, transfer of a liquid between wells, or both of them.

15 37. A method for operating a biochip kit, characterized in that, in a biochip kit according to any of claims 22 to 31 comprising said vessel connected to said biochip, a pressure differential is created between said vessel and said chip or between mutual wells in said chip
20 to cause contact of a liquid with said probe-supported particles within said well(s), transfer of a liquid between wells, or both of them.

38. The method for operating a biochip kit according to any of claims 34 to 37, characterized in that the

solution within said vessel is brought into contact with said probe-supported particles and/or solution within said well(s) to perform mixing, diffusion, reaction, separation, or washing of contents within said biochip.

5 39. The method for operating a biochip kit according to any of claims 34 to 38, characterized in that an identical analyte is introduced into each well in said biochip.

10 40. The method for operating a biochip kit according to any of claims 34 to 38, characterized in that analytes introduced into respective wells in said biochip are different from each other.

15 41. A method for reacting a target contained in an analyte with a probe, characterized by comprising the steps of:

placing specific particles in said wells of said biochip in a kit according to any of claims 22 to 31 to constitute a chip according to any of claims 18 to 21;

20 introducing an analyte-containing solution into said wells in said biochip to bring the system to such a state that said analyte can come into contact with said particles within all the wells; and

vertically moving said wells within said solution contained in the vessel of said biochip, or vertically

moving the interface of said solution contained in the vessel of said biochip, or applying a differential pressure to circulate said solution present within or outside said wells to react said target contained in said analyte with
5 said probe.

42. A method for B/F separation of a target from an analyte, characterized by comprising the steps of:

placing specific particles in said wells in said biochip in a kit according to any of claims 22 to 31 to
10 constitute a chip according to any of claims 18 to 21;

introducing an analyte-containing solution into said wells of said biochip to bring the system to such a state that said analyte can come into contact with said particles within all the wells;

15 lowering the height of the interface of said solution until the position of the interface of said solution is below the lower surface of said filter at the bottom of said well to remove said analyte remaining unreacted with the probe supported on the particle from within each of
20 said wells; and

introducing a washing liquid into said wells in said biochip, circulating said washing liquid through said vessel into said wells in said biochip to introduce said washing liquid into said wells in said biochip and

discharge said washing liquid from said wells in said biochip, and discharging said washing liquid from said wells, whereby substances other than the probe-bound target are removed by washing.

5 43. A method for fractionally isolating a target in an analyte, characterized by comprising the steps of:

 placing specific particles in said wells of said biochip in a kit according to claim 30 or 31 to constitute a chip according to any of claims 18 to 21;

10 introducing an analyte-containing solution into said wells of said biochip to bring the system to such a state that said analyte can come into contact with said particles within all the wells;

 lowering the height of the interface of said solution
15 until the position of the interface of said solution is below the lower surface of said filter at the bottom of said well to remove said analyte remaining unreacted with the probe supported on the particle from within each of said wells;

20 introducing a washing liquid into said wells in said biochip, circulating said washing liquid through said vessel into said wells in said biochip to introduce said washing liquid into said wells in said biochip and discharge said washing liquid from said wells in said

biochip, and discharging said washing liquid from said wells, whereby substances other than the probe-bound target are removed by washing; and

fitting a concave part, a convex part, or a smooth
5 part, provided on the lower end of the well side part of said biochip, and a convex part, a concave part, or a smooth part, corresponding to the concave part, convex part, or smooth part in said biochip, provided on the upper end of said vessel, together, and then introducing a separating
10 agent solution into said wells of said biochip, whereby said target in said analyte is isolated from said particle and is transferred to said wells of said vessel.

44. A method for detecting and identifying an interaction between a target contained in an analyte and a
15 probe, characterized by comprising the steps of:

placing specific particles in said wells of said biochip in a kit according to any of claims 22 to 31 to constitute a chip according to any of claims 18 to 21;

introducing an analyte-containing solution into said
20 wells of said biochip to bring the system to such a state that said analyte can come into contact with said particles within all the wells;

lowering the height of the interface of said solution until the position of the interface of said solution is

below the lower surface of said filter at the bottom of said well to remove said analyte remaining unreacted with the probe supported on the particle from within each of said wells;

5 introducing a washing liquid into said wells in said biochip, circulating said washing liquid through said vessel into said wells in said biochip to introduce said washing liquid into said wells in said biochip and discharge said washing liquid from said wells in said
10 biochip, and discharging said washing liquid from said wells, whereby substances other than the probe-bound target are removed by washing;

 positioning said particles within said wells on said pores in said filter; and

15 detecting and identifying a reaction or an interaction between the probe supported on said particles and the target in said analyte.

 45. The method for detecting and identifying a target contained in an analyte according to claim 44,
20 characterized in that, for each particle, both probe identification information of said particle and information about a reaction or interaction between said probe supported on said particle and said target contained in said analyte are detected.

46. A method for detecting and identifying a target contained in an analyte according to claim 44, characterized in that, for said particles in each well, information about identification of said probe supported on
5 said particles is identified, and the state of an interaction between said probe and said target contained in said analyte is then measured to calculate information about an interaction for each well based on information about the state of interaction for each particle.